LVI.—*Some Remarks on the Dispersal of Marine Animals by means of Seaweeds.* By Rupert Vallentin.

Thanks to the patient investigations of Berkeley, Darwin, Sir Charles Lyell, and others, there are sufficient evidences of the dispersion of land-animals over the globe; but in the case of marine animals it is different. I have hunted in vain through the various publications to which I have had access to find records relating to the subject of this communication.

Early in the summer of last year while surface-netting in my boat about three miles south of Falmouth harbour, I noticed a large mass of *Fucus serratus* being swept away to sea by the ebbing tide. On further examination I found that this weed was suspended vertically in the water, the extremities of the fronds being just level with the calm surface of the sea. On securing this mass of weed, I discovered a large stone attached to its base which weighed three quarters of a pound. Numerous specimens of Hydroids and Polyzoa were also noticed attached to the fronds of this seaweed. Since then I have paid attention to these floating seaweeds when out in my boat, and have recorded my observations in a note-book kept for that purpose.

Attention may here be directed to the fact that the following remarks relate only to our in-shore waters, viz. at a distance not exceeding five miles from land, which is the farthest I have deemed it prudent to venture in so small a craft. Fortunately, however, I was successful in enlisting the co-operation of my friend Mr. J. Tucker, who went during last August from the Clyde to Norway. He was good enough to secure during the voyage specimens of seaweed which were floating in the water or else left stranded on the deck by the waves which occasionally swept over it during the exceptionally wild weather experienced while crossing the North Sea. The weeds thus collected were placed in sea-water in his cabin. Unfortunately the steward, not knowing for what purpose they had been gathered, threw them overboard. I was, however, able to discover that specimens of *Fucus* had been collected in abundance floating in the North Sea long distances from land.

We have had during the past summer strong winds from the west and south-west; and when these winds have been accompanied by a strong ebb-tide great quantities of *Zostera*, *Fucus*, *Chorda*, and other seaweeds are torn from their respective habitats and thrown on shore in the nearest cove. On many occasions the wind has suddenly changed to the

north-west or north, and if the sea has reached a higher level than before the change of wind occurred, large masses of various species of seaweed can be observed being carried to sea by the wind and tide during the following ebb. In addition to this I have quite recently noticed in the numerous creeks with which Falmouth harbour abounds single shells and stones resting on the muddy or sandy sea-bottom with specimens of *Fucus* of various sizes attached to them in a flourishing condition. In every instance the weed is able to maintain a vertical position in the water owing to the presence of the numerous air-vessels on the fronds. In some cases the weed is so large that it can almost float the stone or shell on which it is growing; in others, some time will have to elapse before that can be accomplished. Without much difficulty during any calm day at low-water one can secure similar specimens in all stages of growth.

Attention may here be directed to the rate of flow of the retiring waters during ebb-tides. I am informed by the pilots frequenting this port that under favourable conditions a floating body such as a mass of seaweed would easily be driven five miles from the harbour during an ordinary ebb-tide. If, however, this were supplemented by a fresh north or north-west wind these floating masses would be driven even beyond that limit. Possibly one tide would be spent before the influence of the shore currents would be lost on these floating objects, and before the channel tides would be able to exert their influence on them; but when once these latter came into play there is no knowing where they might be swept to.

Before proceeding further, I will now record some experiments I have made as to the powers of flotation of some of our common seaweeds in sea-water. I have had portions of *Fucus nodosus* floating in vessels of sea-water for eleven and a half weeks, and *F. serratus* for upwards of seven weeks. On the other hand, *Fucus vesiculosus* never floated longer than five weeks. Specimens of *Halidrys siliquosa* floated in some instances for three weeks, and other examples for as many months. Many specimens of *Zostera marina* were found to float never longer than three days; they then invariably sank to the bottom of the jar in which they had been placed. Attempts were also made to discover how long the fronds of *Chorda filum* remained floating in the water, and during calm days several examples were moored in very sheltered places in the harbour. But these experiments were invariably unsuccessful, mainly owing to the surface-motion produced by passing steamers. I may mention that all these various

species of seaweed were obtained either in the bay or harbour, where they were drifting about in the tideways after being detached from their respective habitats by the force of the waves.

As my most interesting results have been obtained from the class Mollusca it will be convenient to take my starting point from those animals. Mr. Wallace (1)*, under the heading of "Means of dispersal of Mollusca," writes as follows:— "The marine, fresh-water, and land mollusca are three groups whose powers of dispersal and consequent distribution are very different and must be separately considered. The Pteropoda and Ianthina and other groups of floating mollusks drift about in mid-ocean, and their dispersal is probably limited chiefly by temperature, but perhaps also by the presence of enemies or the scarcity of proper food. The univalve and bivalve mollusca, of which the whelk and cockle may be taken as types, move so slowly in their adult state, that we should expect them to have an exceedingly limited distribution; but the young of all these are free-swimming embryos, and they thus have a powerful means of dispersal, and are carried by tides and currents so as ultimately to spread over every shore and shoal that offers conditions favourable for their development." Prof. W. Sollas (2) remarks as follows:— "Perhaps one of the commonest ways by which marine animals obtain a distribution over extensive areas is by means of free-swimming larvæ. The peopling of the sea by slow-moving or attached forms has certainly been accomplished chiefly, if not almost wholly, in this manner."

I have been fortunate enough to secure two specimens of bivalve mollusks while being dispersed by floating seaweed; and, strange as it may appear, one was a specimen of *Cardium edule*, a long frond of *Chorda filum* being attached to the left valve by its base. This mollusk was secured a mile from land, and was found on examination to be alive and in a healthy condition. Unfortunately this specimen and the attached weed were placed after examination on the deck of my canoe, and were washed overboard by a wave. A short time later a fine living example of *Mytilus edulis* was secured under similar circumstances and weighed 23·3 grms. The weed, *Chorda filum*, was also in this instance firmly fixed to the left valve; it measured 310 centim. in length and weighed 43·3 grms. Had these mollusks escaped the notice of cod, pollock, or other fish which frequent the mid-water regions, they might have been carried by the currents on some shoal or bank, and so founded fresh colonies.

As *Chorda filum* invariably floats vertically, I have found

* These numbers refer to bibliographical list at end.

it very difficult to detect specimens drifting in the sea, unless there is an almost complete calm accompanied with bright sunshine.

Numerous examples of single valves of *Tapes pullastra*, *Ostrea edulis*, fragments of *Corallina*, and stones of various sizes have frequently been observed drifting in the tideways attached to the roots of *Chorda filum* and various species of *Fucus*.

Only two species of Nudibranchs have been secured on drift-weed. Two specimens of *Polycera quadrilineata* were found early in July, and several examples of *Acanthidoris pilosa* were captured early during the following month on masses of *Fucus serratus* while travelling seawards. On a similar clump of weed a large coil of spawn, deposited by *Aplysia hybrida*, was once noticed. Microscopical examination of these ova showed that segmentation was just completed.

The polychæte annelid, *Spirorbis borealis*, is very common on the fronds of *Fucus serratus*. It will be remembered that the embryos of this species are kept inside its tube until they are in an advanced condition and almost ready to lead an independent life. This fact doubtless greatly assists in the propagation of the species. Specimens of this annelid attached to the fronds of *Fucus serratus* can be secured in the tideways on almost any occasion.

Very frequently, particularly during the months of June, July, and August, specimens of *Idotea tricuspidata* have been found holding fast to the fronds of *Halidrys siliquosa*. These crustaceans are exceedingly difficult to detect, as they invariably adapt their colour to suit their surroundings, and also hold the stem of the drifting weed longitudinally.

The undermentioned species of Hydroids have been observed on drift seaweed: *Clava multicornis* and *Sertularia pumila* occur in abundance on the fronds of *Fucus versiculosus* and *F. serratus*, and *Aglaophenia pluma* at times covers the fronds of *Halidrys siliquosa*. The following examples of Polyzoa will be sufficient for my present purpose:—*Bicellaria ciliata* and *Mimosella gracilis* are both to be secured in abundance on the fronds of *Halidrys siliquosa*. *Membranipora pilosa*, *Flustra foliacea*, and *Valkeria uva* have repeatedly been observed alive and in a healthy condition growing on detached portions of *Fucus serratus* gathered in the bay and harbour. The common anemone, *Anthea cereus*, is usually to be found adhering to rocks in pools of water between tide-marks; it also luxuriates on the fronds of *Laminaria* a few feet below low-water mark. In sheltered places in Falmouth harbour large areas exist covered with sea-grass (*Zostera*

marina), to the leaf-like fronds of which these anemones delight to adhere with their broad disks. Indeed in this district this actinian seems to prefer this weed to any other, a fact I have not seen recorded in any of the scientific publications to which I have had access. During the fall of every year the blade-like portions of this weed become detached and are soon carried by the currents into the tideways. A single extract from my note-book will be sufficient to confirm this fact. On the 7th of September, while standing on the extremity of the eastern breakwater, I noticed large quantities of *Zostera marina* being swept to sea by the ebbing tide, and in one instance three specimens of *Anthea cereus* were observed adhering to the same weed with their tentacles fully expanded.

Geographical Distribution of the above-mentioned Species.

According to Messrs. Forbes and Hanley (3) "*Cardium edule* has a wide range, extending southward to the Canary Isles." *Mytilus edulis*, according to the same authorities, "ranges all round the coasts of the North Atlantic, on both its eastern and western sides, and into the Mediterranean."

Acanthodoris pilosa and *Polycera quadrilineata* are both generally distributed around the British coasts; while *Aplysia* is found along the shores of the Mediterranean and also at Madeira.

The polychæte annelid *Spirorbis borealis*, in addition to being generally distributed along the shores of Great Britain and Ireland, is also found on the coasts of Norway, France, and Denmark.

Idotea tricuspidata has been captured on the Cornish and Devonshire coasts, and also along the south-western shore of Ireland and the western coast of Scotland. This species is abundant in the Mediterranean.

Turning now to Hydroids and Polyzoa. According to Mr. T. Hincks (4), *Clava multicornis* is "generally distributed on our coasts." *Sertularia pumila* is also "generally distributed."

Aglaophenia pluma, according to that author (4), "is much more at home in the south and west than in the north.... Throughout the north it seems to be sparingly distributed, whilst along the south-western coasts it is extremely abundant and of great size and beauty." This species has been recorded on the Belgian coast, and is not uncommon in the Bay of Naples.

Bicellaria ciliata, *Membranipora pilosa*, and *Flustra foliacea* are all generally distributed round our British coasts (5), the two former being also found on the east coast of France,

and the last-named extending all along the shores of the Mediterranean as far as Suez. *Mimosella gracilis* is only found on the shores of Devon and Cornwall.

According to Mr. Gosse (6), *Anthea cereus* is found at Madeira.

I think the foregoing examples are sufficient to demonstrate clearly that seaweeds, and particularly those furnished with air-vessels, have played in the past, as they continue to do at present, a most important part in the dispersal of many of our littoral forms over the globe.

References.

(1) Wallace, Alfred R.—The Geographical Distribution of Animals. London, 1876.
(2) Sollas, W. J.—On the Origin of Freshwater Faunas: a Study in Evolution. Sci. Trans. Royal Dublin Society, vol. iii. (ser. ii.) part 5. Nov. 1884.
(3) Forbes, E., and Hanley, S.—A History of British Mollusca and their Shells.
(4) Hincks, Thomas.—A History of British Hydroid Zoophytes.
(5) Hincks, Thomas.—A History of British Marine Polyzoa.
(6) Gosse.—A History of British Sea-Anemones and Corals.

LVII.—*Description of a new Species of* Scolopendra *from the Solomon Islands.* By R. I. Pocock.

Scolopendra metuenda, sp. n.

Colour. The terga a deep olive-chestnut, head nearly black; antennæ, legs, and sterna rather greener than the terga; at the posterior end of the body the chestnut colour predominates on the somites.

Head without sulci, finely punctured, a little wider than long.

Antennæ long and slender, composed of 19 or 20 long cylindrical segments, whereof the basal five are smooth, though punctured, and the rest pubescent.

Maxillipedes finely punctured, the precoxal plates very short, but wide, with convex distal edges, each furnished with upwards of a dozen or more small, in parts nearly obsolete, teeth, which present the appearance of having been worn away; the femoral process simple, small, and curved back against the appendage.

Tergites. First without either longitudinal or transverse sulci; on the rest the longitudinal sulci start upon the third and extend to the twentieth, but are everywhere faint (except upon the extreme anterior and posterior edges of the terga), and almost die out in the middle of the body; a faint shallow median longitudinal furrow upon the terga. The lateral margin from the third to the twenty-first elevated.

Sternites smooth and shining, weakly bisulcate.

Anal somite small; *tergite* not mesially sulcate, its width equal to the length of its lateral margin, but a little less than its median